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IS/QC 750105 (1994): Semiconductor Devices - Discrete Devices - Signal (Including Switching) and Regulator Diodes -Blank Detail Voltage-Regulator Diodes and Voltage-Reference Diodes, Excluding Temperature-Compensated Precision Reference Diodes [LITD 5: Semiconductor and Other Electronic Components and Devices]

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Indian Standard

SEMICONDUCTOR DEVICES — DISCRETE DEVICES — SIGNAL (INCLUDING SWITCHING) AND REGULATOR DIODES — BLANK DETAIL SPECIFICATION FOR VOLTAGE-REGULATOR DIODES AND VOLTAGE-REFERENCE DIODES, EXCLUDING TEMPERATURE-COMPENSATED PRECISION REFERENCE DIODES

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Semiconductor Devices and Integrated Circuits Sectional Committee, LT 10

NATIONAL FOREWORD

This Indian Standard, which is identical with IEC Pub 747-3-2/ QC 750105 (1986) 'Semiconductor devices — Discrete devices — Part 3 : Signal (including switching) and regulator diodes, Section Two — Blank detail specification for voltage-regulator diodes and voltage-reference diodes, excluding temperature — compensated precision reference diodes', issued by the International Electrotechnical Commission (IEC), was adopted by the Bureau of Indian Standards on the recommendation of Semiconductor Devices and Integrated Circuits Sectional Committee (LT 10) and approval of the Electronics and Telecommunication Division Council.

The text of IEC standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

> Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC Pub 747-10/QC 700000 (1984)	IS QC 700 000 : 1989 Semiconductor devices: Generic specification for discrete devices and integrated circuits	Identical
IEC Pub 747-11/QC 750000 (1985)	IS QC 750000 : 1989 Semiconductor devices: Sectional specification for discrete devices	Identical

The concerned technical committee has reviewed the provisions of the IEC Pub 68-2-17, IEC Pub 191-2, IEC Pub 747-3 and IEC Pub 749, referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard.

This Indian Standard is intended primarily for use under the IECQ system. A regular Indian Standard for this component could be different, identical or similar to this standard.

Only the English language text in the International Standard has been retained while adopting it as Indian Standard.

IS QC 750105 : 1994
IEC QC 750105 : 1986

Indian Standard

SEMICONDUCTOR DEVICES — DISCRETE DEVICES — SIGNAL (INCLUDING SWITCHING) AND REGULATOR DIODES — BLANK DETAIL SPECIFICATION FOR VOLTAGE-REGULATOR DIODES AND VOLTAGE-REFERENCE DIODES, EXCLUDING TEMPERATURE-COMPENSATED PRECISION REFERENCE DIODES

INTRODUCTION

The IEC Quality Assessment System for Electronic Components is operated in conformance with the statutes of the IEC and under the authority of the IEC. The object of this system is to define quality assessment procedures in such a manner that electronic components released by one participating country as conforming with the requirements of an applicable specification are equally acceptable in all other participating countries without the need for further testing.

This blank detail specification is one of a series of blank detail specifications for semiconductor devices and shall be used with the following IEC publications:

- 747-10/QC 700000 (1984): Semiconductor Devices, Part 10: Generic Specification for Discrete Devices and Integrated Circuits.
- 747-11/QC 750000 (1985): Semiconductor Devices, Part 11: Sectional Specification for Discrete Devices.

Required information

Numbers shown in brackets on this and the following page correspond to the following items of required information, which should be entered in the spaces provided.

Identification of the detail specification

[1] The name of the National Standards Organization under whose authority the detail specification is issued.

[2] The IECQ number of the detail specification.

[3] The number and issue number of the generic and sectional specifications.

[4] The national number of the detail specification, date of issue and any further information required by the national system.

Identification of the component

[5] Type of component.

[6] Information on typical construction and applications. If a device is designed to satisfy several applications, this should be stated here. Characteristics, limits and inspection

requirements for these applications shall be met. If a device is electrostatic sensitive, a caution statement should be added in the detail specification.

[7] Outline drawing and/or reference to the relevant document for outlines.

[8] Category of assessed quality.

[9] Reference data on the most important properties to permit comparison between component types.

[Throughout this standard, the texts given in square brackets are intended for guidance to the specification writer and should not be included in the detail specification.]

[Throughout this standard, when a characteristic or rating applies, "x" denotes that a value shall be inserted in the detail specification.]

[Name (address) of responsible NAI
(and possibly of body from which specification is available).] ①

QC 750005 – xxx ②
[Number of IECQ detail specification,
plus issue number and/or date.]

ELECTRONIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH: ③
Generic specification: Publication 747-10/QC 700000
Sectional specification: Publication 747-11/QC 750000
[and national references if different].

[National number of detail specification.] ④
[This box need not be used if national number repeats IECQ number.]

DETAIL SPECIFICATION FOR: ⑤
[Type number(s) of the relevant device(s).]
Ordering information: see Clause 7 of this standard.

1. Mechanical description

Outline references: ⑦
IEC 191-2..... [mandatory if available] and/or national [if there is no IEC outline].

Outline drawing
[may be transferred to or given with more details in Clause 10 of this standard].

Terminal identification
[drawing showing pin assignments, including graphical symbols].

Marking: [letters and figures, or colour code].
[The detail specification shall prescribe the information to be marked on the device, if any.]
[See Sub-clause 2.5 of generic specification and/or Clause 6 of this standard.]
[Polarity indication, if special method is used.]

2. Short description

Voltage-regulator diodes (Reg.) ⑥
Voltage-reference diodes (Ref.)
(excluding temperature-compensated precision reference diodes)
Semiconductor material: [Si].
Encapsulation: [cavity or non-cavity].

3. Categories of assessed quality

[from Sub-clause 2.6 of the generic specification]. ⑧

Reference data ⑨

Information about manufacturers who have components qualified to this detail specification is available in the current Qualified Products List.

4. **Limiting values** (absolute maximum rating system)

These values apply over the operating temperature range, unless otherwise specified.

[Repeat only sub-clause numbers used, with title. Any additional values should be given at the appropriate place, but without sub-clause number(s).]

[Curves should preferably be given under Clause 10 of this standard.]

Sub-clause	Parameters	Symbol	Value	
			Min.	Max.
4.1	Operating ambient or case temperatures	$T_{amb/case}$	x	x
4.2	Storage temperatures	T_{stg}	x	x
4.3	Power dissipation: [Special requirements for ventilation and mounting should be specified.]			
4.3.1	Maximum power dissipation P_{tot} as a function of temperature or:			
4.3.2	Maximum virtual (equivalent) junction temperature,	$T_{(vj)}$		x
	and maximum power dissipation	P_{tot}		x
4.4	Where appropriate, maximum value of forward current	I_F		x
4.5	Where appropriate, maximum continuous (direct) reverse current	I_Z		x
	This should be given in two parts:			
4.5.1	List, for the given type, of I_{Zmax} (corresponding to P_{tot}) for each V_Z voltage, at T_{amb} or T_{case} = 25 °C			
4.5.2	Where appropriate, similar list at T_{amb} or T_{case} = [temperature specified for the endurance test]			

5. **Electrical characteristics** (see Clause 8 of this standard for inspection requirements)

[Repeat only sub-clause numbers used, with title. Any additional characteristics should be given at appropriate place but without sub-clause number.]

[When several devices are defined in the same detail specification, the relevant values should be given on successive lines, avoiding repeating identical values.]

[Curves should preferably be given under Clause 10 of this standard.]

Sub-clause	Characteristics and conditions at T_{amb} or T_{case} = 25 °C unless otherwise specified (see Clause 4 of the generic specification)	Symbol	Ref.		Reg.		Tested
			Min.	Max.	Min.	Max.	
5.1	Minimum, nominal and maximum values of working voltage at a specified current (continuous (direct) or pulse as specified in the detail specification) (see Sub-clause 2.4 of the generic specification)	V_Z	x	x	x	x	A2b
5.2	Maximum reverse current at a voltage specified in the detail specification: – between 60% and 85% of V_{Zmin} when $V_{Znom} > 5.6$ V – preferably between 25% and 50% of V_{Zmin} when $V_{Znom} \leqslant 5.6$ V (see page 17)	I_{R1}		x		x	A3
5.3	Where appropriate, maximum reverse current at a voltage specified as in 5.2 and at a high temperature	I_{R2}		x		x	C2b
5.4	Maximum differential resistance at the current specified in 5.1 (continuous (direct) or pulse as specified in the detail specification)	r_Z		x		x	A2b
5.5	Where appropriate, maximum differential resistance at a recommended minimum operating current	r_{ZK}		x		x	C2a
5.6	Where appropriate, maximum forward voltage at specified forward current I_F	V_F		x		x	C2a
5.7	Minimum and maximum values of temperature coefficient of working voltage at the current specified in 5.1 and over a specified temperature range	α_{VZ}	x	x	–	–	C2a
5.8	Where appropriate, maximum noise voltage at a specified operating current, centre frequency and bandwidth	V_n		x		–	C2a
5.9	Where appropriate, maximum value of capacitance at specified reverse voltage V_R	C_{tot}		x		x	C2a
5.10	Where virtual junction temperature is quoted as a rating: maximum value of thermal resistance junction-to-ambient or case or lead with specified clamping distance	R_{th}		x		x	

6. Marking

[Any particular information other than given in box ⑦ (Clause 1) and/or Sub-clause 2.5 of the generic specification shall be given here.]

7. Ordering information

[The following minimum information is necessary to order a specific device, unless otherwise specified:

- precise type reference (and nominal voltage value, if required);
- IECQ reference of detail specification with issue number and/or date when relevant;
- category of assessed quality as defined in Sub-clause 3.7 of sectional specification and, if required, screening sequence as defined in Sub-clause 3.6 of sectional specification;
- any other particulars.]

8. Test conditions and inspection requirements

[These are given in the following tables, where the values and exact test conditions to be used shall be specified as required for a given type, and as required by the relevant test in the relevant publication.]

[The choice between alternative tests or test methods shall be made when a detail specification is written.]

[When several devices are included in the same detail specification, the relevant conditions and/or values should be given on successive lines, where possible avoiding repetition of identical conditions and/or values.]

Throughout the following text, reference to sub-clause numbers is made with respect to the generic specification unless otherwise stated and test methods are quoted from Clause 4 of the sectional specification.

[*FOR SAMPLING REQUIREMENTS*, EITHER REFER TO, OR REPRODUCE, VALUES OF SUB-CLAUSE 3.7 OF SECTIONAL SPECIFICATION, ACCORDING TO APPLICABLE CATEGORY(IES) OF ASSESSED QUALITY.]

[*FOR GROUP A*, THE CHOICE BETWEEN AQL OR LTPD SYSTEM SHALL BE MADE IN THE DETAIL SPECIFICATION.]

GROUP A

Lot by lot

All tests are non-destructive (3.6.6)

Inspection or test	Symbol	Ref.	Conditions at T_{amb} or T_{case} = 25 °C unless otherwise specified (see Clause 4 of the generic specification)	Inspection requirement limits	
				Ref. and Reg.	
				Min.	Max.
Sub-group A1 External visual examination		4.2.1.1			
Sub-group A2a Inoperative devices				Inverted polarity, or V_F > [10 V_F max.] or I_R > [100 I_{R1} max.] [unless otherwise specified]	
Sub-group A2b Working voltage	V_Z	D-021	Current = [specified, continuous (direct) or pulse as specified]	x	x
Differential resistance	r_Z	D-022	Current = [the same as for V_Z above, continuous (direct) or pulse as specified]		x
Sub-group A3 Reverse current	I_{R1}	D-002	Voltage = [specified in the detail specification: – between 60% and 85% of V_Z min. when V_Z nom. > 5.6 V – preferably between 25% and 50% of V_Z min. when V_Z nom. ≤ 5.6 V (see page 19)]		x

Note. — References for measuring methods: see sectional specification 747-11/QC 750000.

Preferred values of reverse voltage V_R

[Voltage V_R to be specified in Sub-clause 5.2 and sub-group A3 for the measurement of I_{R1} should *whenever possible* be chosen from the following, where column (*) is preferred]:

(E24) V_Z nom. (V)	V_R * (V)
2.4	0.6
2.7	0.7
3.0	0.8
3.3	1.0
3.6	1.0
3.9	1.0
4.3	1.0
4.7	1.5
5.1	1.5
5.6	1.5
6.2	3.6

(E24) V_Z nom. (V)	V_R (V)	
	*	
6.8	4.7	5.1
7.5	5.1	5.6
8.2	5.6	6.2
9.1	6.2	6.8
10	6.8	7.5
11	7.5	8.2
12	8.2	9.1
13	9.1	10
15	10	11
16	11	12
18	12	13
20	13	15
22	15	16
24	16	18
27	18	20
30	20	22
33	22	24
36	24	27
39	27	30

(E24) V_Z nom. (V)	V_R (V)	
	*	
43	30	33
47	33	36
51	36	39
56	39	43
62	43	47
68	47	51
75	51	56
82	56	62
91	62	68
100	68	75
110	75	82
120	82	91
130	91	100
150	100	110
160	110	120
180	120	130
200	130	150

[This table is intended for guidance of the specification writer and should not be included in the detail specification.]

GROUP B

Lot by lot

(In the case of category I, see the generic specification, Sub-clause 2.6)

IVD = initial value of individual device
LSL = lower specification limit } from group A
USL = upper specification limit } from group A

Only tests marked (D) are destructive (3.6.6)

Inspection or test	Symbol	Ref.	Conditions at T_{amb} or T_{case} = 25 °C unless otherwise specified (see Clause 4 of the generic specification)	Inspection requirement limits	
				Min.	Max.
Sub-group B1 Dimensions		4.2.2, app. B		[See Clause 1 of this standard]	
Sub-group B3 *Robustness of terminations* Where applicable: • Lead bending (D)		749, II, 1.2	Force = [see 749, II, 1.2]	No damage	
Sub-group B4 Solderability		749, II, 2.1	[As specified; solder bath preferred]	Good wetting	
Sub-group B5 Rapid change of temperature, followed by either: – Damp heat, cyclic (D) (for non-cavity devices) *with final measurements:* [see below] or: – Sealing (for cavity devices)		749, III, 1 749, III, 4 749, III, 7	[As specified] [As specified] Sub-clauses 7.2, 7.3 or 7.4 combined with Test Qc, 68-2-17	[See below]	
Sub-group B8 Electrical endurance (168 h) *with final measurements:* [see below]		747-3, ch. V	[High-temperature reverse bias or operating life]	[See below]	
Sub-group CRRL			Attributes information for B3, B4, B5 and B8		

Final measurements:

[– For voltage-regulator diodes: as in sub-group A2b.

– For voltage-reference diodes:

- $r_Z \leqslant 1.2$ USL
- At specified I_Z: $|\Delta V_Z| \leqslant 1\%$ IVD for devices with tolerances ± 1% or tighter than ± 1%.
  $|\Delta V_Z| < 2\%$ IVD for devices with tolerances wider than ± 1%.]

[*Grouping for endurance tests:* Attention is drawn to Sub-clause 3.2.3.1 of the sectional specification, Publication 747-11.]

GROUP C

Periodic

LSL = lower specification limit } from group A
USL = upper specification limit }

Only tests marked (D) are destructive (3.6.6)

Inspection or test	Symbol	Ref.	Conditions at T_{amb} or T_{case} = 25 °C unless otherwise specified (see Clause 4 of the generic specification)	Inspection requirement limits			
				Ref.		Reg.	
				Min.	Max.	Min.	Max.
Sub-group C1 Dimensions		4.2.2, app. B		[See Clause 1 of this standard]			
Sub-group C2a Temperature coefficient of working voltage	α_{VZ}	D-023	Test current = [specified for V_Z in A2b], Temperatures = [specified]	x	x	–	–
Where appropriate, Noise voltage	V_n	D-024	Operating current, centre frequency and bandwidth = [specified]		x		–
Where appropriate, Forward voltage	V_F	D-001	Forward current I_F = [specified]		x		x
Where appropriate, Total capacitance	C_{tot}	D-006	Reverse voltage V_R = [specified]		x		x
Where appropriate, Differential resistance	r_{ZK}	D-022	Current = [recommended minimum operating current]		x		x
Sub-group C2b Reverse current at high temperature	I_{R2}	D-002	Voltage = [specified as for I_{R1} in A3], Temperature = [high]		x		x
Sub-group C3 *Robustness of terminations*:* Tensile (D) and/or Torque		749, II, 1.1 749, II, 1.4	Values = [specified]	No damage			
Sub-group C4 Resistance to soldering heat (D) *with final measurements:* [see Notes 1 or 2, page 25]		749, II, 2.2		[As in Note 1 page 25]		[As in Note 2 page 25]	
Sub-group C6 Vibration or shock, followed by acceleration, steady-state [for cavity devices only] *with final measurements:* [see Notes 1 or 2, page 25]		749, II 3, 4, 5	[As specified]	[As in Note 1 page 25]		[As in Note 2 page 25]	

[* May not be required for special outlines, such as microminiature devices.]

(Table continued, page 25)

GROUP C *(continued)*

Inspection or test	Symbol	Ref.	Conditions at T_{amb} or $T_{case} = 25$ °C unless otherwise specified (see Clause 4 of the generic specification)	Inspection requirement limits			
				Ref.		Reg.	
				Min.	Max.	Min.	Max.
Sub-group C7 Damp heat, steady state (D) or: Damp heat, cyclic (D) [for non-cavity devices only] *with final measurements:* [see Notes 1 or 2 below]		749, III, 5 749, III, 4	[As specified]	[As in Note 1 below]		[As in Note 2 below]	
Sub-group C8 Electrical endurance (1000 h min.) *with final measurements:* [see Notes 1 or 2 below]		747-3, ch. V	[High temperature reverse bias or operating life]	[As in Note 1 below]		[As in Note 2 below]	
Sub-group C9 Storage at high temperature (D) *with final measurements:* [see Notes 1 or 2 below]		749, III, 2	Min.: 1000 h at $T = [T_{stg}$ max.]	[As in Note 1 below]		[As in Note 2 below]	
Sub-group CRRL			Attributes information for C2, C3, C4, C6, C7 and C9. Measurement information for V_Z before and after C8				

[*Note 1.* — Voltage-reference diodes: $r_Z \leqslant 1.2$ USL
at specified I_Z: $|\Delta V_Z| \leqslant 1\%$ IVD for devices with tolerances ±1% or tighter than ±1%
$|\Delta V_Z| \leqslant 2\%$ IVD for devices with tolerances wider than ±1%.]

[*Note 2.* — Voltage-regulator diodes: $r_Z \leqslant 1.2$ USL
at specified I_Z: LSL $\leqslant V_Z \leqslant$ USL.]

9. Group D — Qualification approval tests

[When required, these tests shall be prescribed in the detail specification.]

10. Additional information (not for inspection purposes)

[To be given only as far as necessary for the specification and use of the device, for instance:

- temperature derating curves referred to in the limiting values;
- complete definition of a circuit for measurement, or of an additional method;
- detailed outline drawing.]